



NAVAL  
POSTGRADUATE  
SCHOOL

# Welcome Mr. George Solhan, SES

Director, Chief of Naval Research for Expeditionary Maneuver Warfare and Combating Terrorism; and Director, Marine Corps Science and Technology

The Nation's Premier Defense Research University

Monterey, California  
[WWW.NPS.EDU](http://WWW.NPS.EDU)



Presentation to the  
Naval Post-graduate School,  
Monterey, CA

**October 2006**

# ONR's Mission...

**T**o foster, plan, facilitate, and transition scientific research in recognition of its paramount importance to enable future naval power and the preservation of national security.

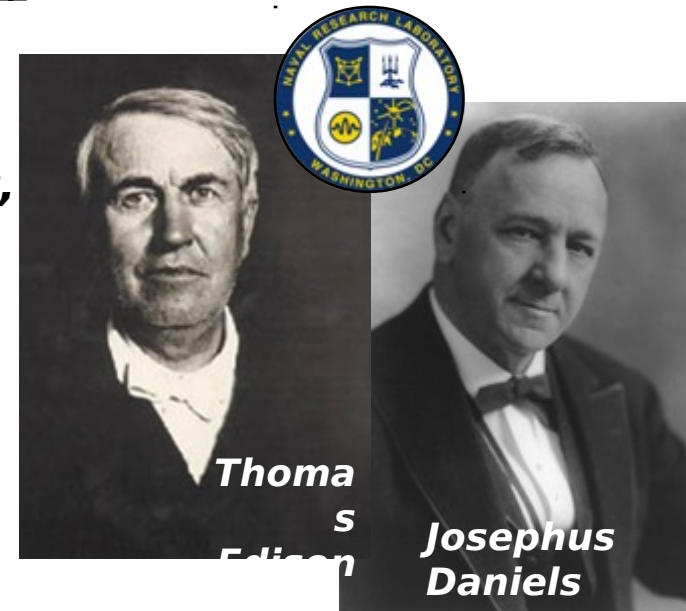


# Naval Research: A Statutory Mission

## Naval Research Laboratory (Appropriations Act, 1916):

***“[Conduct] exploratory and research work... necessary... for the benefit of Government service, including the construction, equipment, and operation of a laboratory.”***  
Office of Naval Research (Public Law 588, 1946):

***“... plan, foster, and encourage scientific research in recognition of its paramount importance as related to the maintenance of future naval power, and the reservation of national security.... ”***



## Transitioning S&T (Defense Authorization Act, 2001):

***“...manage the Navy’s basic, applied, and advanced research to **foster transition** from science and technology to higher levels of research, development, test, and evaluation.”***

**ONR is an Echelon 1 Command**



# ONR S&T Departments

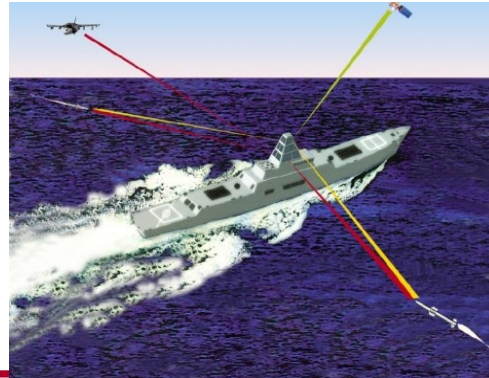
**Code 30**

**Expeditionary Warfare  
& Combating Terrorism**



**Code 31**

**C4ISR**



**Code 32**

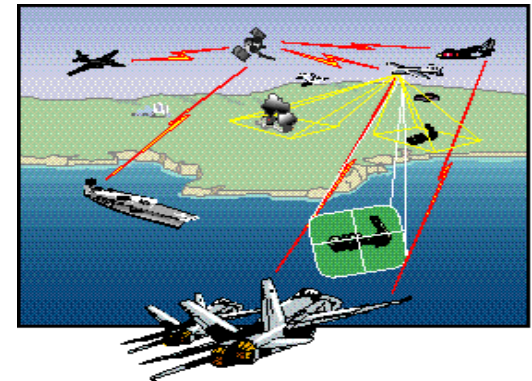
**Ocean Battlespace Environment**



**Sea Warfare and Weapons**

**Warfighter Performance**

**Air Warfare and Weapons**



**Code 33**

**Code 34**

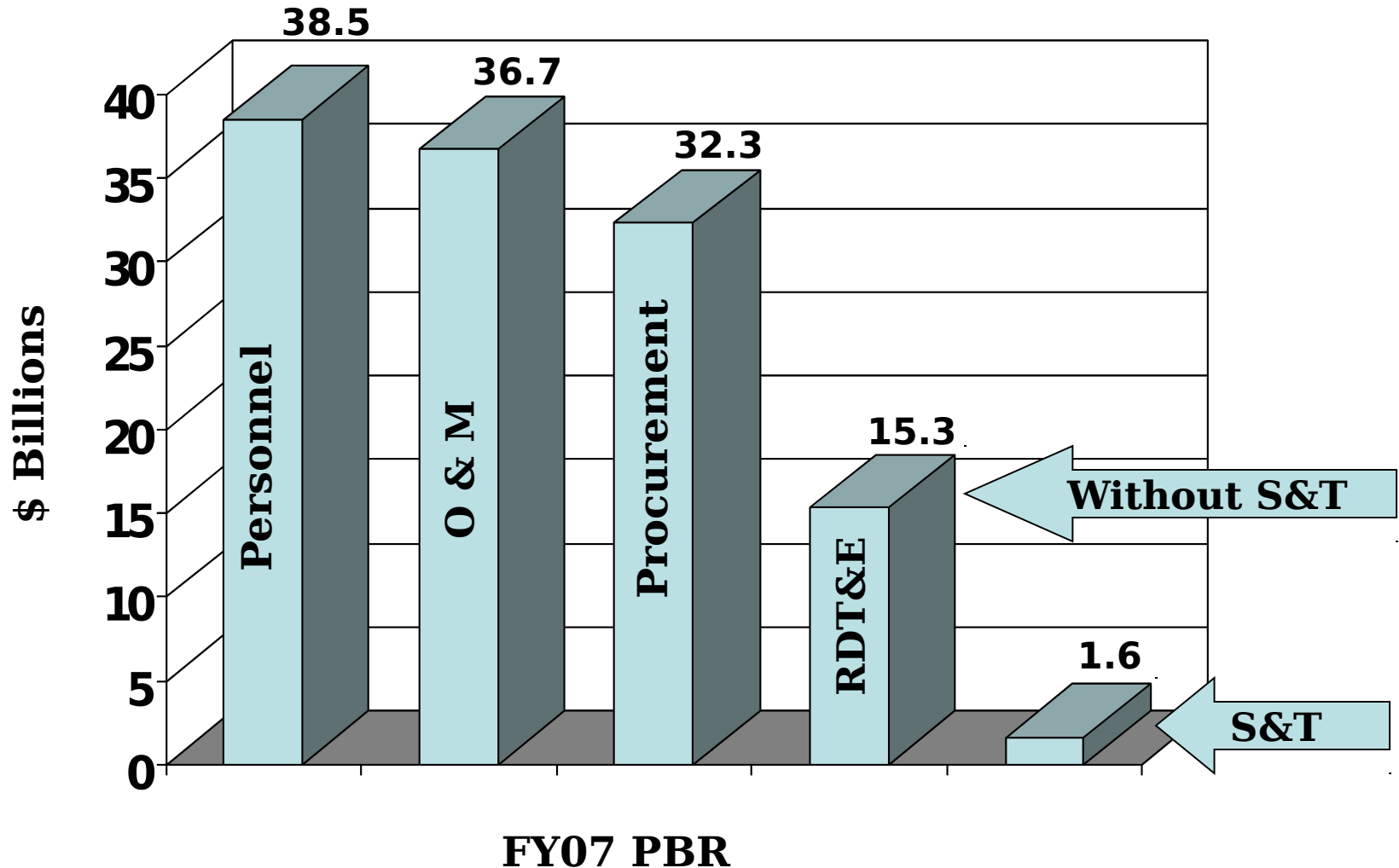
**Code 35**

# The Office of Naval Research Is . . .

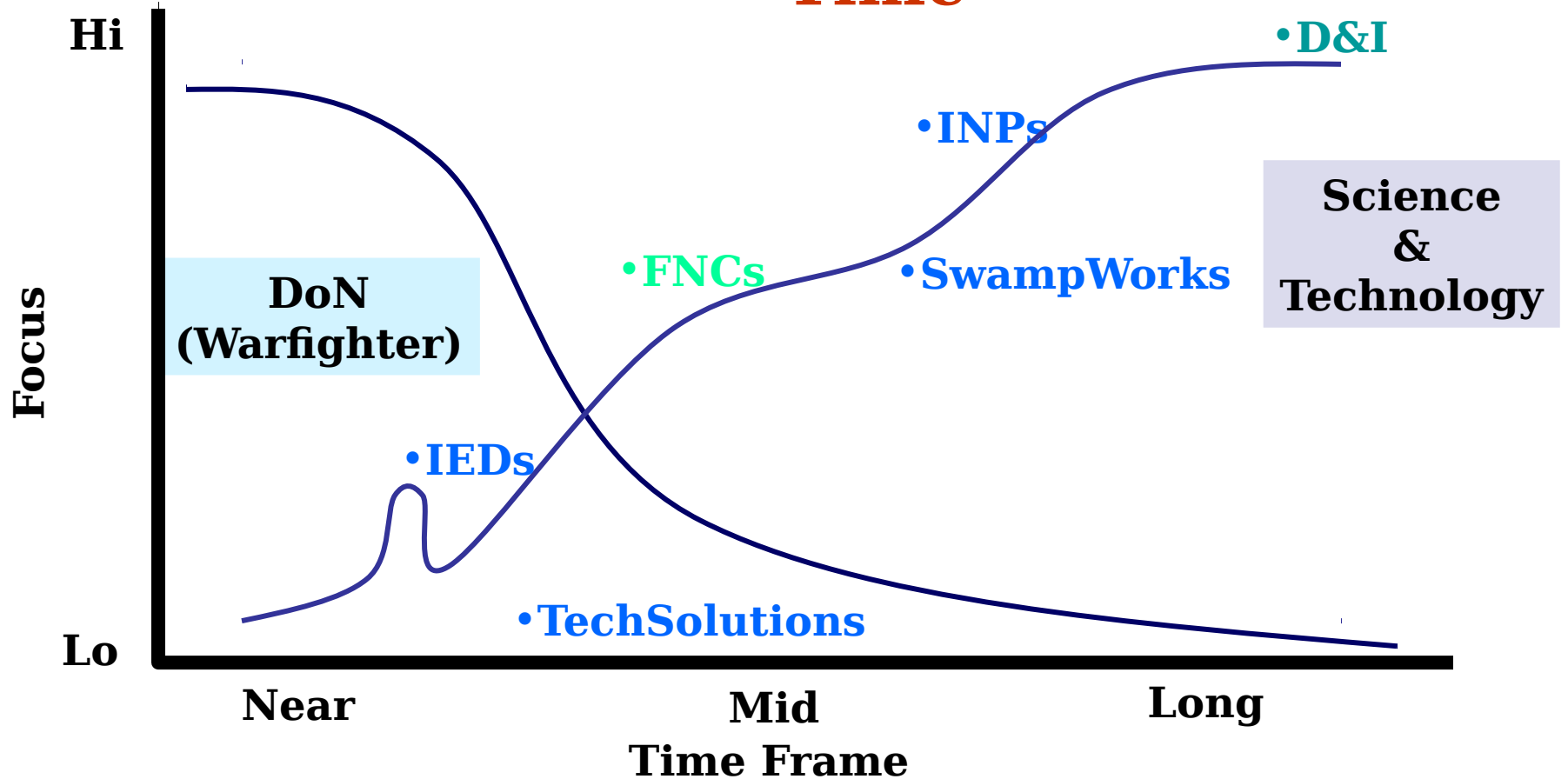
- Focused on advancing the Navy/Marine Corps vision
- Innovative in product and process
- Flexible enough to solve ***today's*** critical challenges while focusing on ***tomorrow*** and the Navy and Marine Corps after Next
- *The* focal point for all science and technology research in the Navy and Marine Corps

*And we excel in transitioning science, technology, and ideas to the Fleet/Force*

# Navy Science and Technology Budget in Perspective



# Conceptual View of DoN Warfighters & S&T Focus Over Time



## Leap-ahead Innovation (\$160M, 10%)

- Innovative Naval Prototypes
- SWAMPWORKS
- Experimentation
- Tech Solutions

## Acquisition Enablers (\$585M, 39%)

- Future Naval Capabilities
- Warfighter Protection
- Capable Manpower
- LO/CLO

## Discovery & Invention (\$627M, 42%)

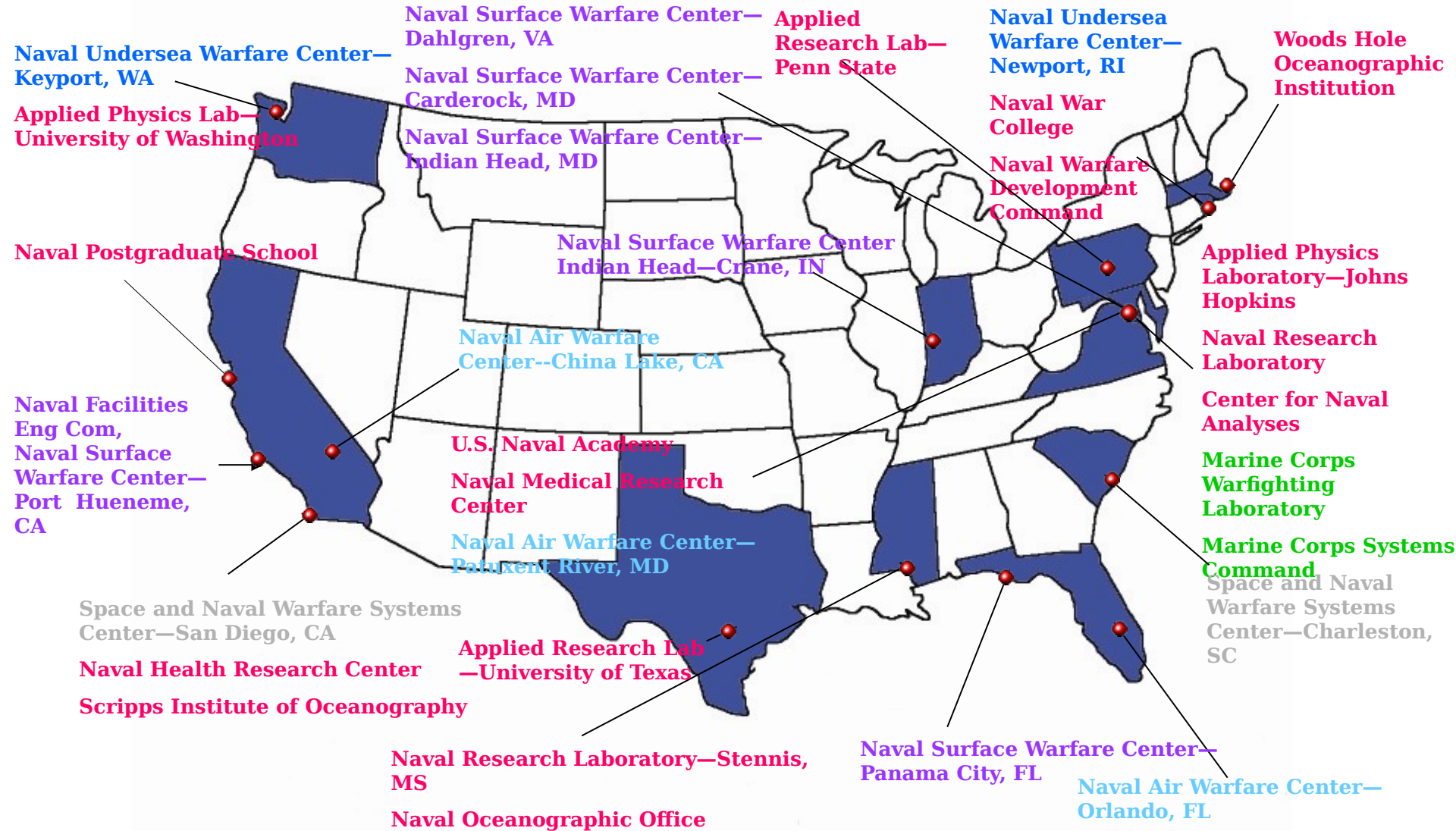
- Basic & Early Applied Research
- National Naval Responsibilities
- Education Outreach HBCU/MI

## OSD Partnered (\$135M, 9%)

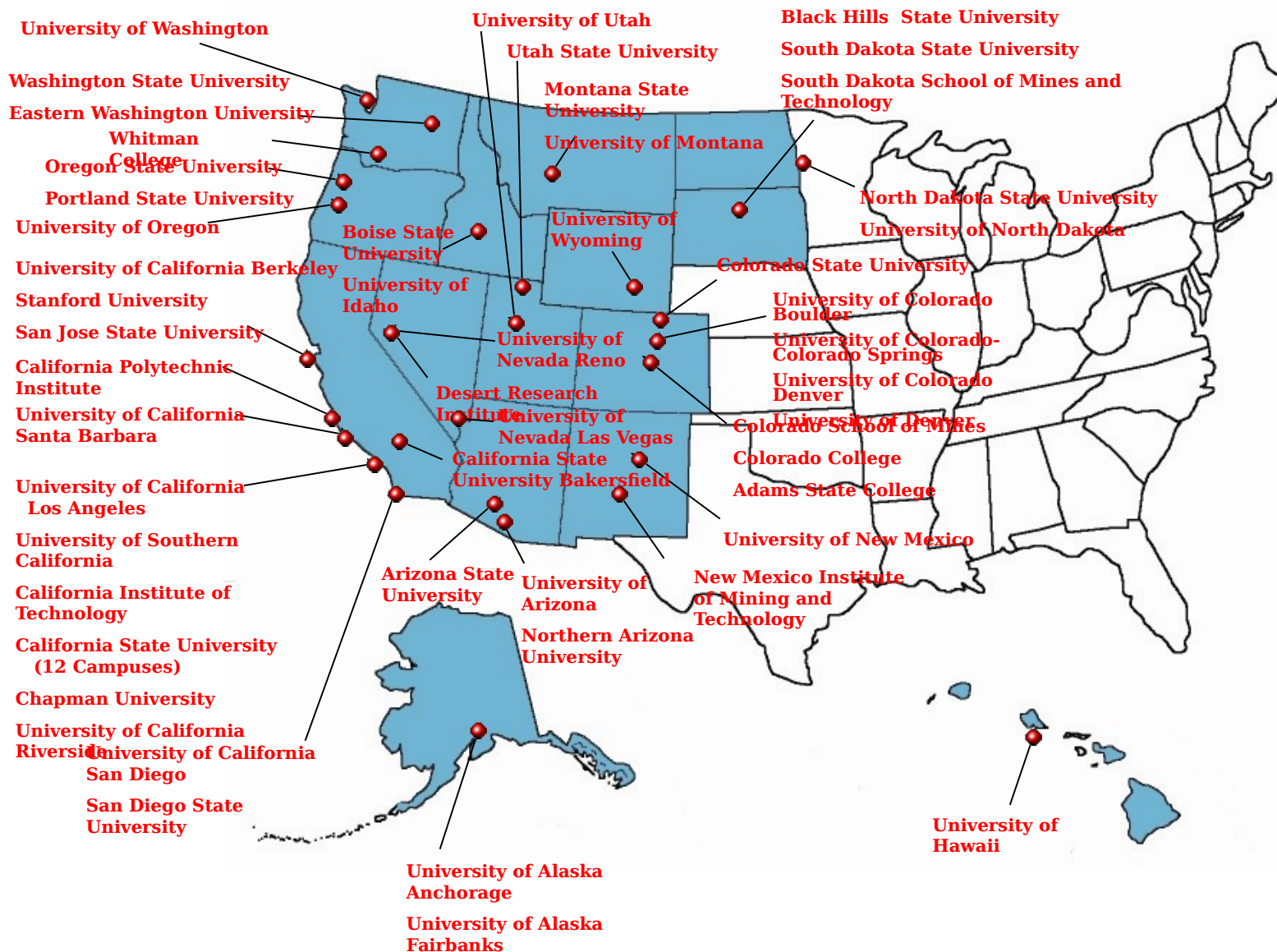
- Advanced Energetic Materials
- Energy and Power
- Surveillance & Knowledge Systems
- Research Tools Consortia
- OSD Initiatives



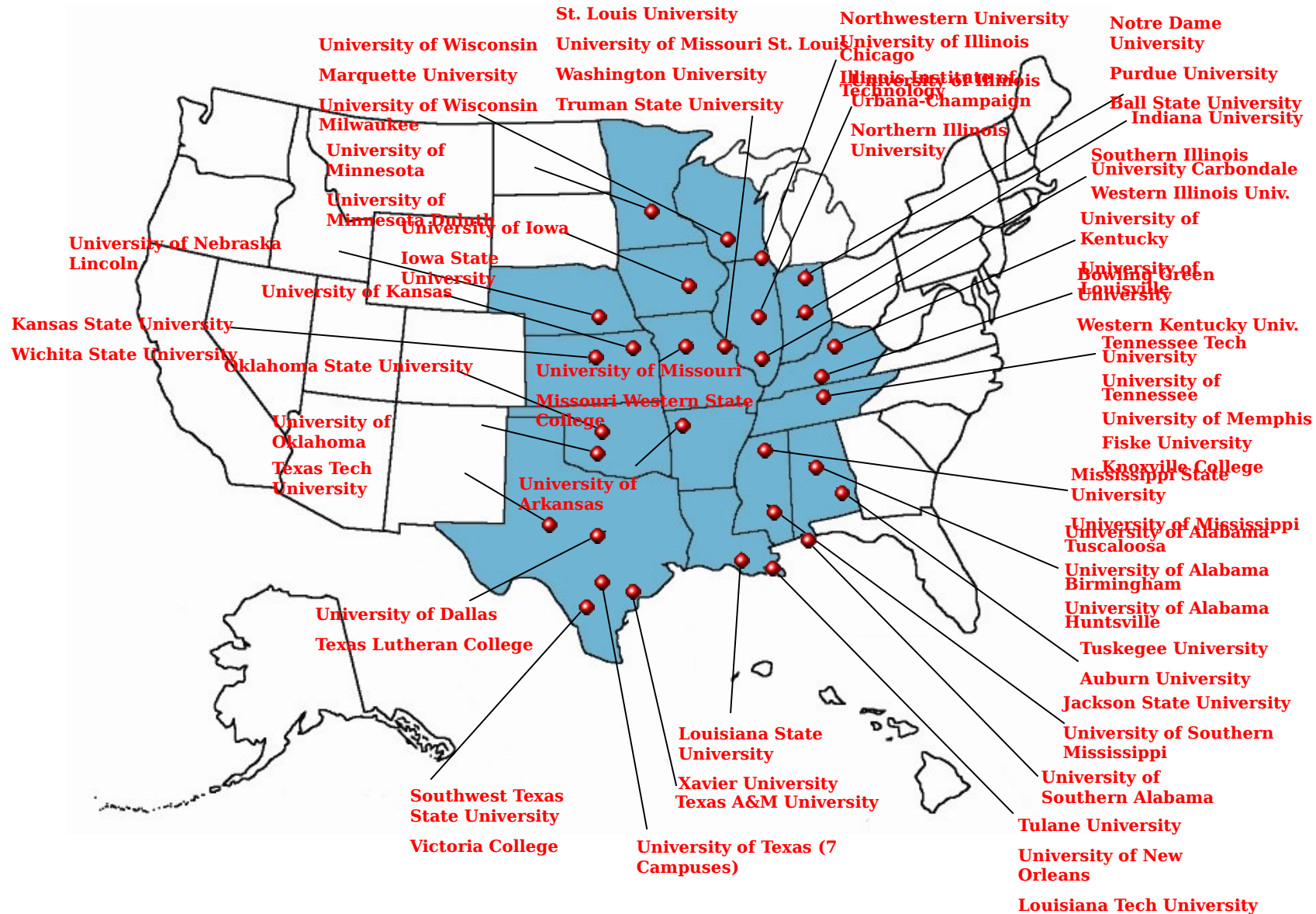
# Leveraging the Naval Research Enterprise



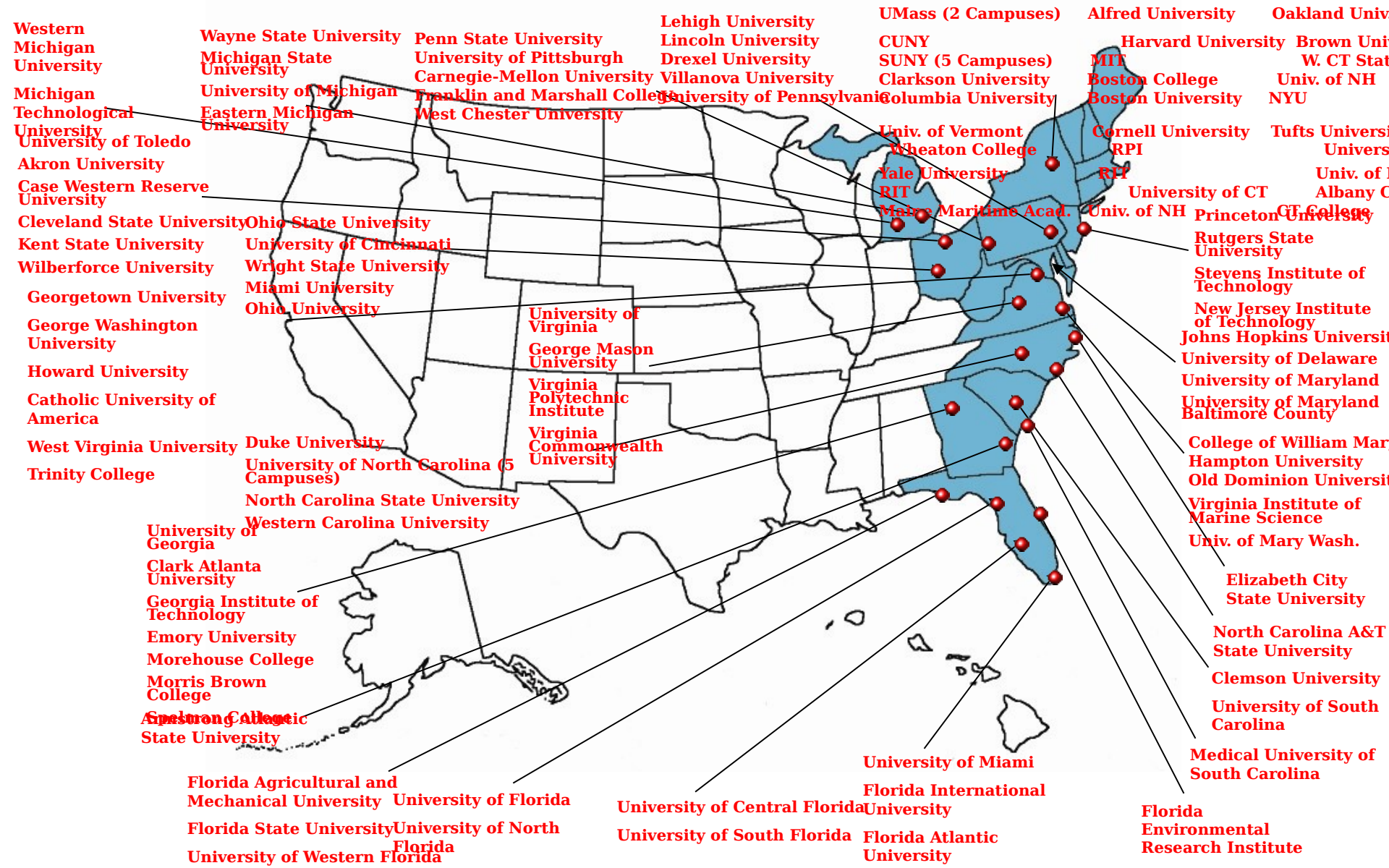
# Leveraging Academia



# Leveraging Academia



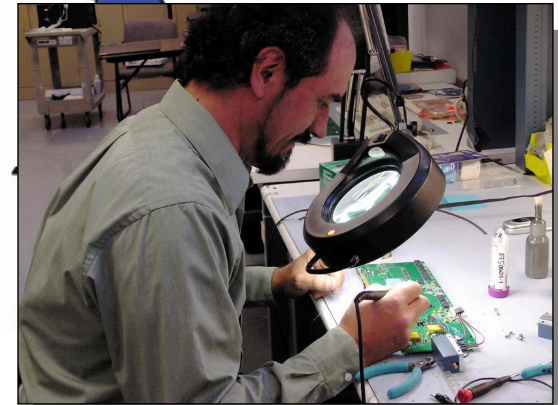
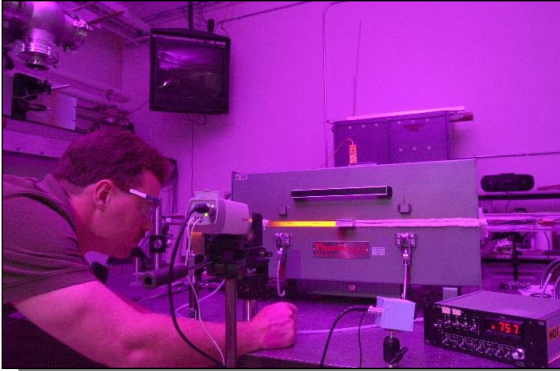
# Leveraging Academia





# Leveraging Industry and Small Businesses

**ONR connects with companies, small businesses, and nonprofit labs and organizations in every state in the country**







# ONR Global Presence



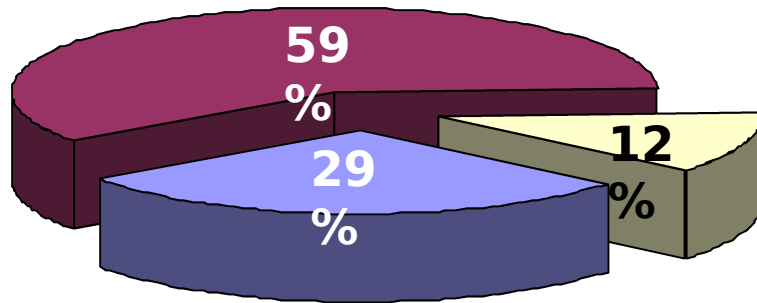
★ Joint Command

☆ Naval Command

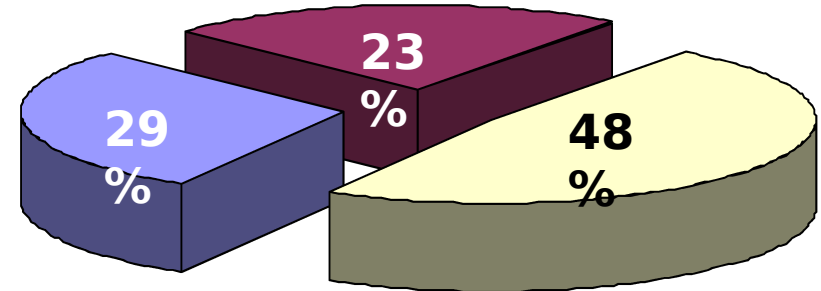
# Navy Science and Technology Investment

**Core TOA @ \$1.5B**

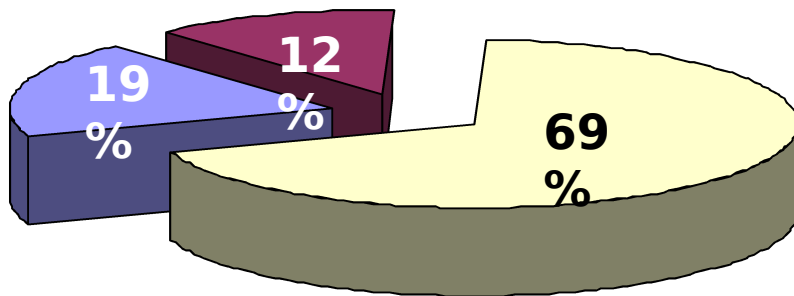
**Congressional Add @ \$1.0B**



***Basic Research***



***Applied Research***

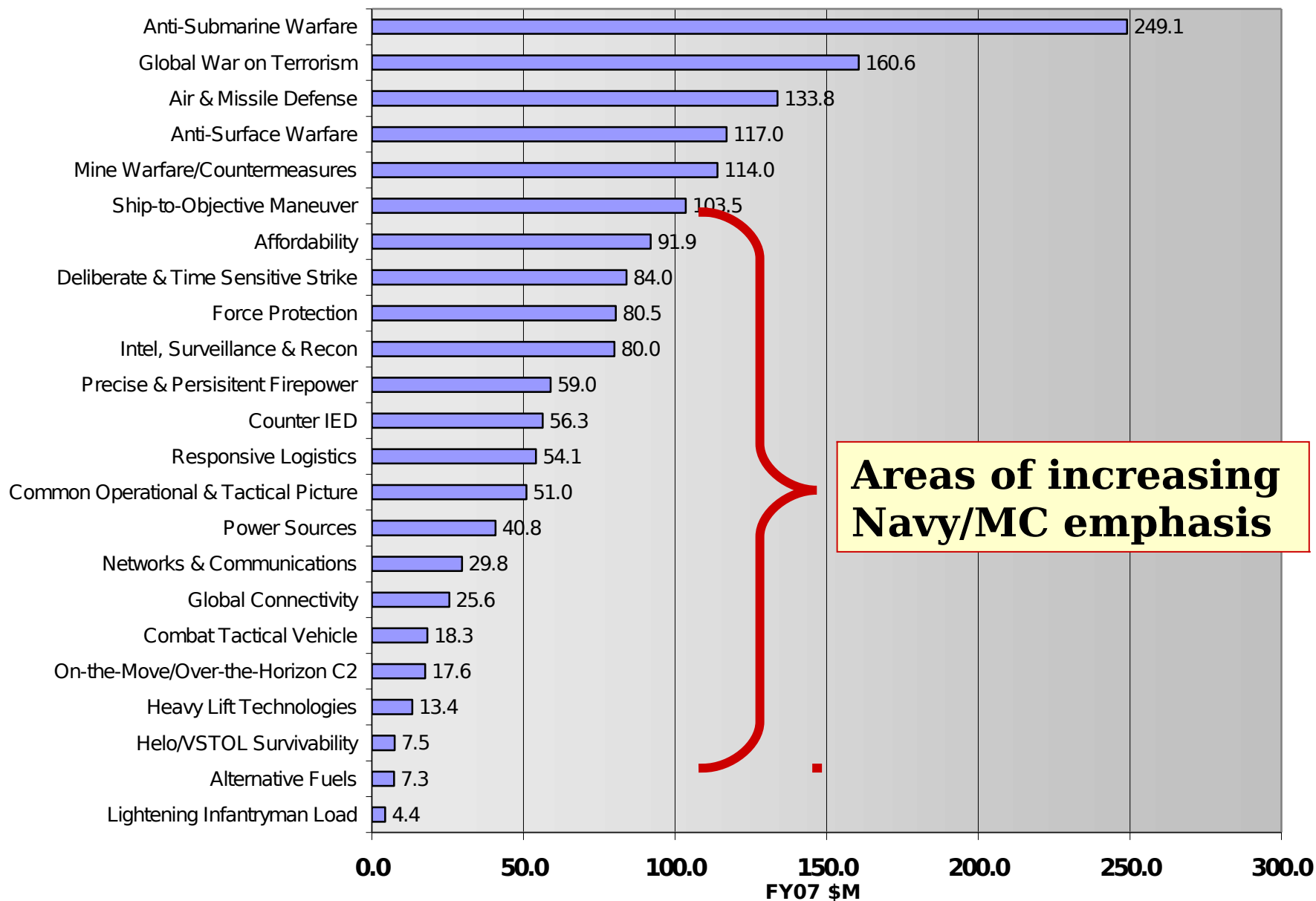


***Advanced Technology Development***

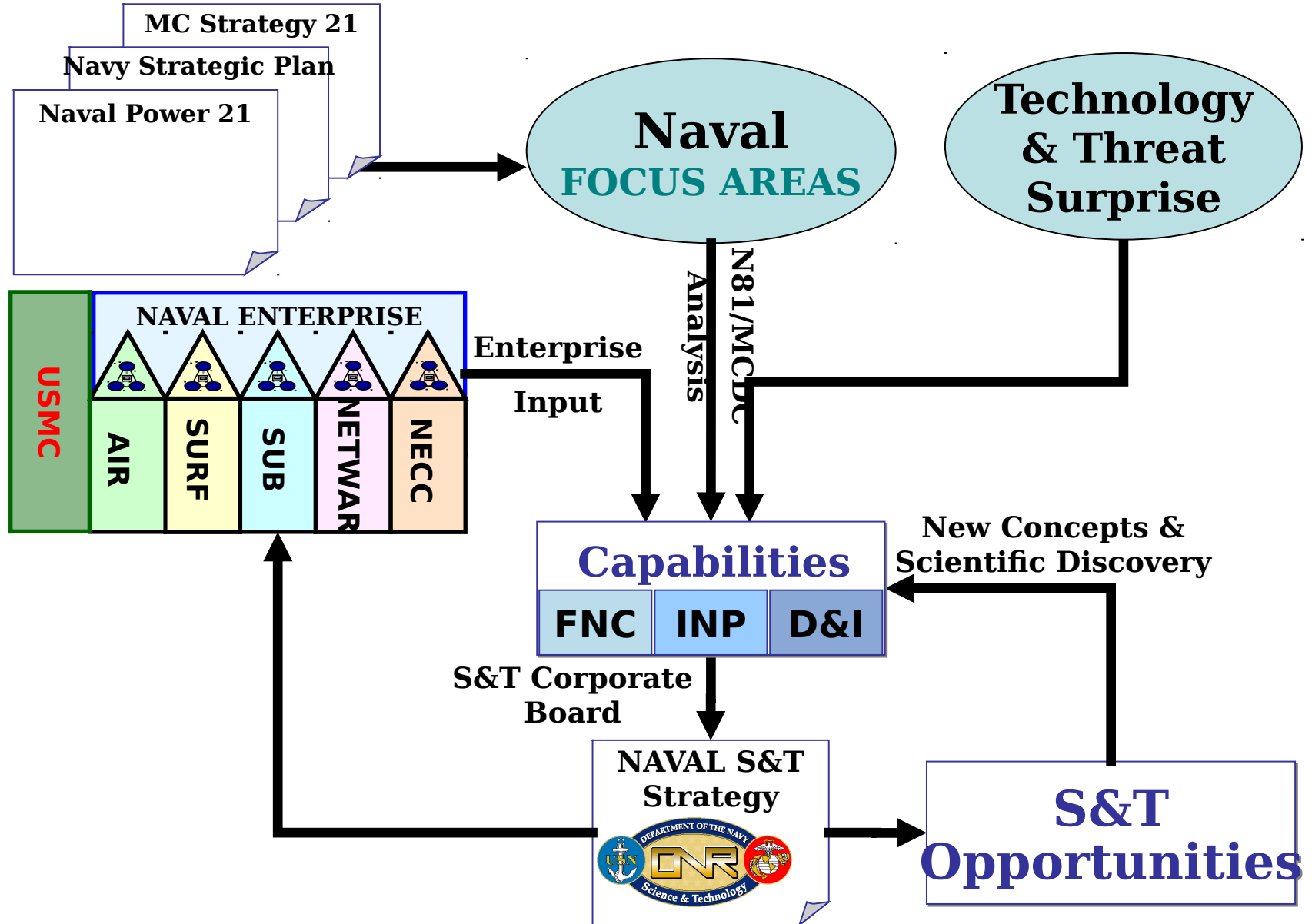


FY 2005 Obligations as of 30 Sep 05  
 (Preliminary Performer Percentages 3/06)

# Science and Technology Investment by Current Capability Area



# Naval S&T Strategy Process





# The Challenges of a Changing World





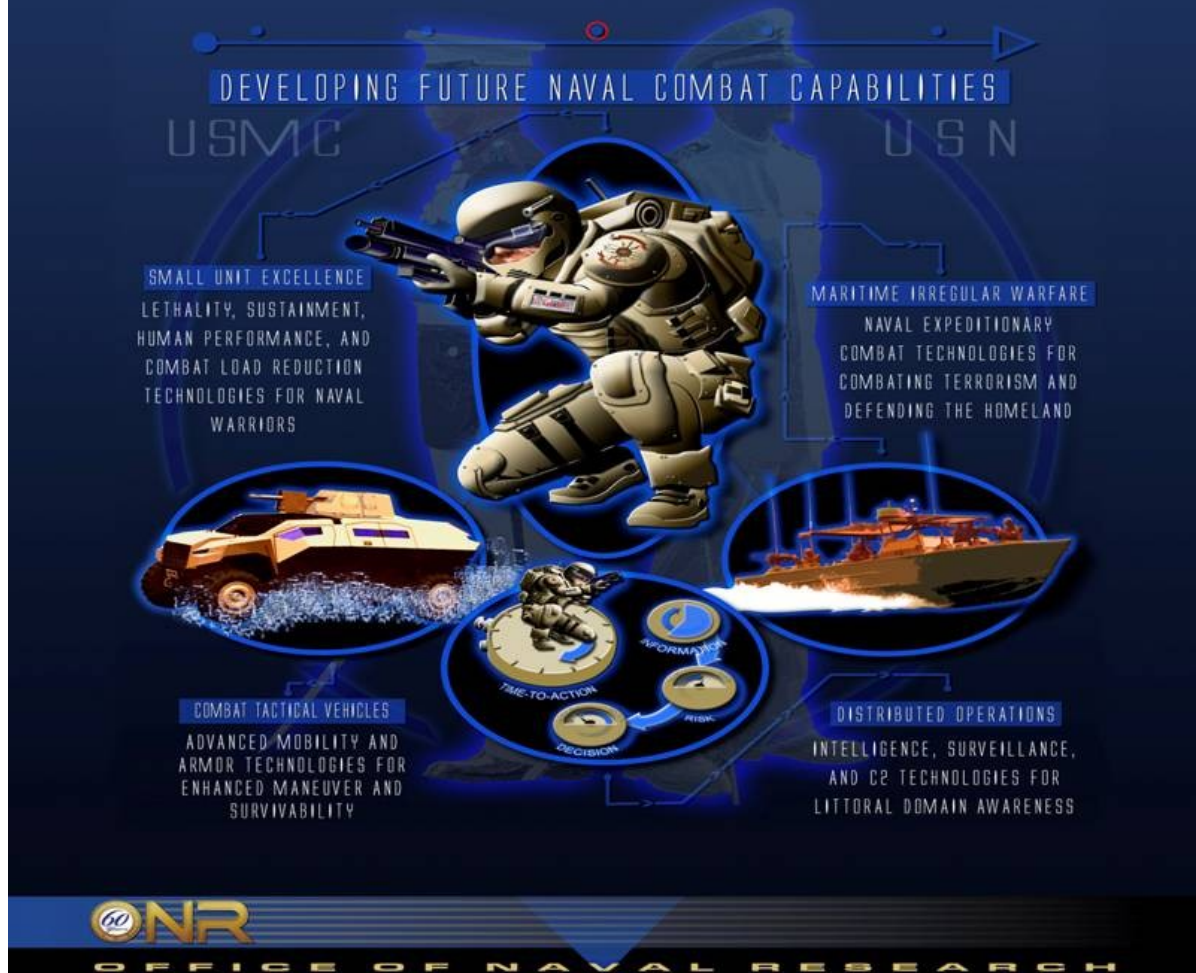
**Mr. George W. Solhan**

**Expeditionary  
Maneuver Warfare  
& Combating Terrorism  
S&T Department**

**Code 30**



**Looking to the future....  
Never forgetting the past!**



# ONR 30 Mission: Expeditionary Maneuver Warfare and Combating Terrorism

## Office of Naval Research (Public Law 588, 1946):

*"... **plan, foster, and encourage scientific research** in recognition of its paramount importance as related to the maintenance of **future naval power**, and the **preservation of national security**.... "*

## Expeditionary Maneuver Warfare and Combating Terrorism (Code 30)

*To lead the Department of the Navy's Science and Technology efforts that develop future **combat capabilities for Naval Expeditionary Maneuver Warfare and the Department's role in Combating Terrorism**:*

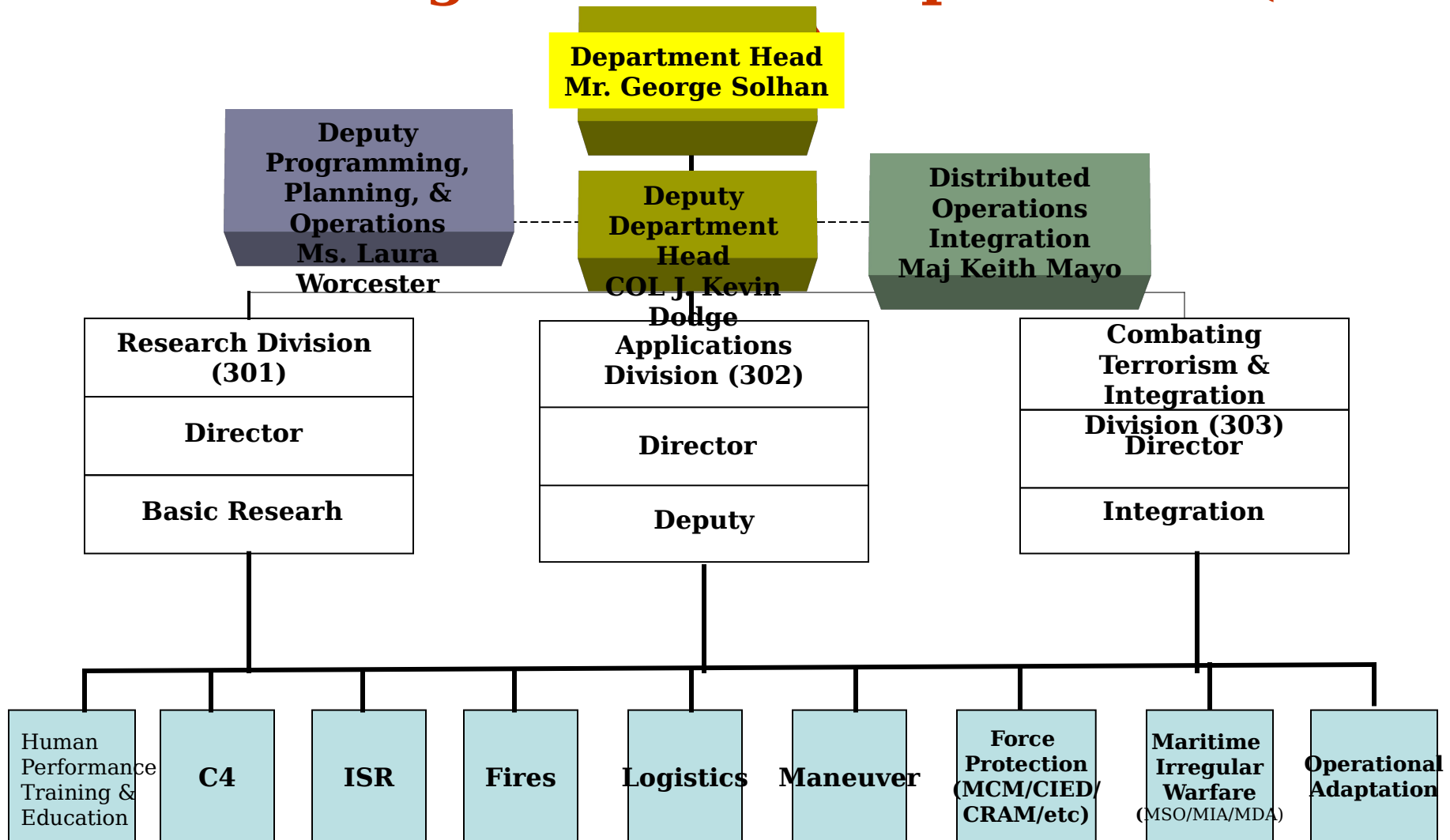
*...the exploitation and subsequent application of Science and Technology in order to enhance the ability of the **Navy-Marine Corps team to achieve assured access and conduct decisive operations as the naval portion of a joint campaign.***



# S & T Departments: Customers and Portfolios

	FORCENet	SEA SHIELD	SEABASE	SEA WARRIOR	SEA STRIKE
MCCDC, MCWL, MARCORSYSCOM, MARFOR, NAVFAC, NCIS, DTRA, DHS, SOCOM, SPECWARCOM, JNLW Directorate, Army Research Lab, NECC, MARSOC	SPAWAR, NETWARCOM, ONI, NRO, NSA	N096, NAVMETOC, CORE, NOPP, NOAA, NASA, UNOLS	NAVSEA, NAVSURFOR, NAVSUBFOR, NAVAIRFOR (for ship systems), USCG, DOE	Surgeon General, Medical Officer of the USMC, CNET, CNP, NIH	NAVAIR, NAVAIRFOR, Air Force Research Lab
DASN LMW	DASN IWS/LMW/ AIR/C4I	DASN SHIPS/ IWS/AIR	DASN SHIPS/LMW	DASN SHIPS/C4I/ LMW	DASN SHIPS/ IWS/AIR
30 – Exp. Warfare & Combating Terrorism	31 – C4ISR	32 – Ocean Battlespace Environment	33 – Sea Warfare and Weapons	34 – Warfighter Performance	35 – Air Warfare and Weapons
Exp. Man. Warfare, USMC STOs in multiple warfighting areas – C4; ISR; Logistics; Human Performance Training &	Electronics, Computer & Info Sciences, Radar/EO/IR, Maritime sensors, EM propagation	Oceanography, Coastal Geosciences, Marine geology & geophysics, Modeling & Sim, Marine meteorology	Chemistry, Power & energy conversion, Naval materials, Non-linear dynamics, Ship Structures	Cognitive science, Neural science, Behavioral science, Social org./science, Manpower,	Physics, Aerospace materials, Energetics, Surface & Air launched weapons

# Expeditionary Maneuver Warfare & Combating Terrorism Department (Code



# Navy Strategic Plan Alignment

Most Contested- Least Invested

Maritime Irregular Warfare  
 Asymmetric Warfare  
 Combating Terrorism

Symmetric

Asymmetric

MCO

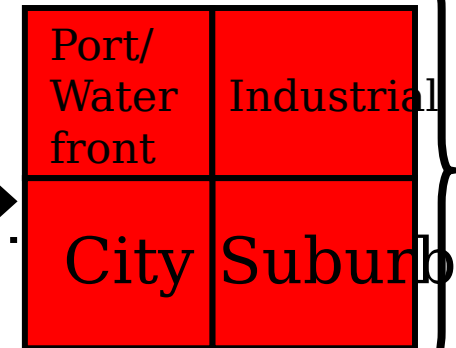
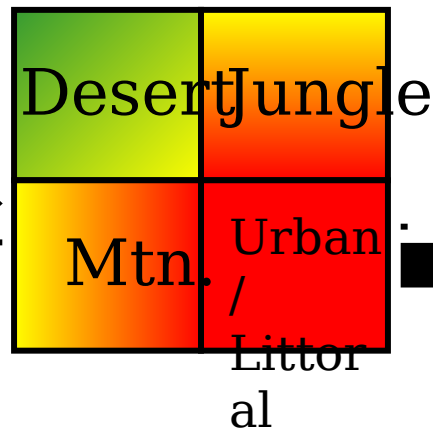
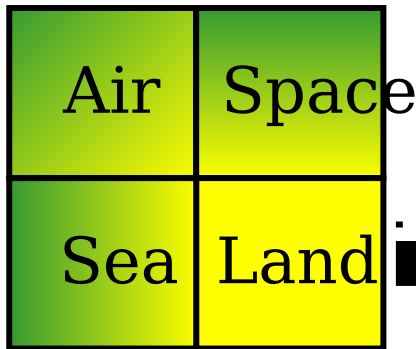
Strik

IW

SASO

Hum.

Maritime Domain

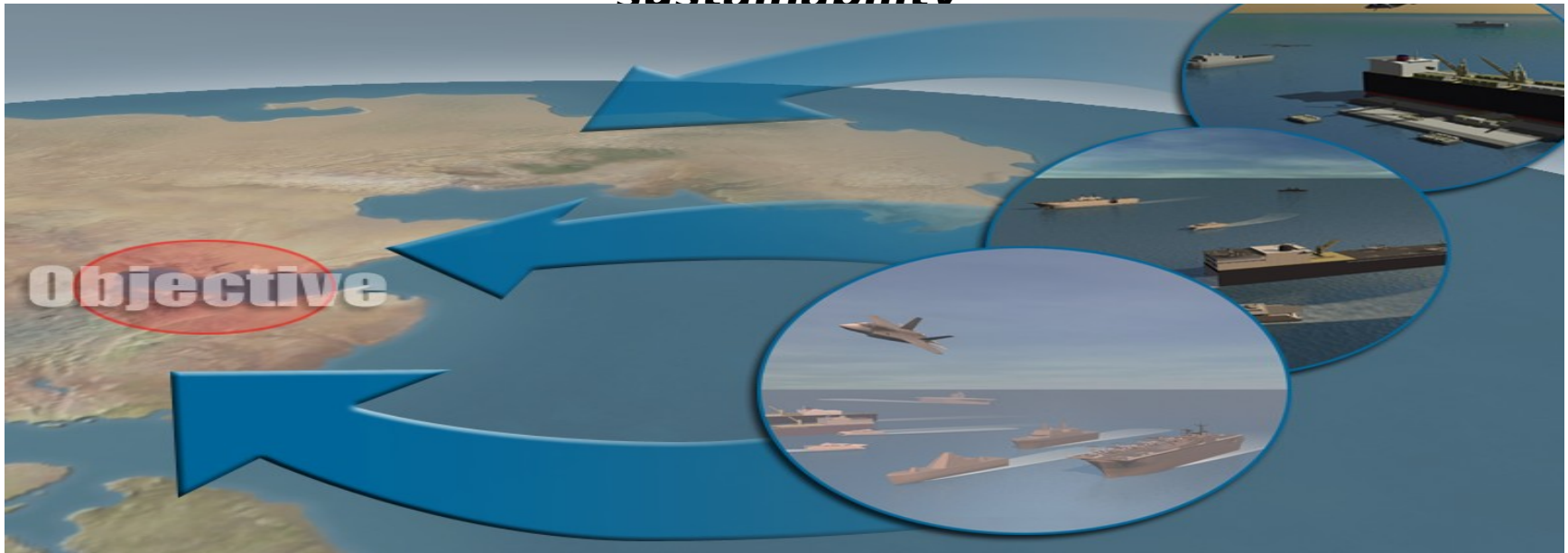


Urban Littoral Area



# Distributed Operations (DO)

***“Maneuver Warfare is the shift from quantitative characteristics of warfare - mass and volume - to qualitative factors of speed, stealth, precision, and sustainability”***



***“Distributed Operations constitutes a form of Maneuver Warfare. The essence of this concept lies in the capacity for coordinated action by highly capable units, dispersed throughout the breadth and depth of the battlespace, ordered and **connected** within an operational design focused on a common aim.”***

# S&T Requirements Process “Top Down”



**Expeditionary Maneuver Warfare  
Capabilities List (ECL)/  
Navy Strategic Plans**

**USMC/USN S&T Strategic Plan**

**S&T Investment Plan**

**Multi-Year S&T Program**

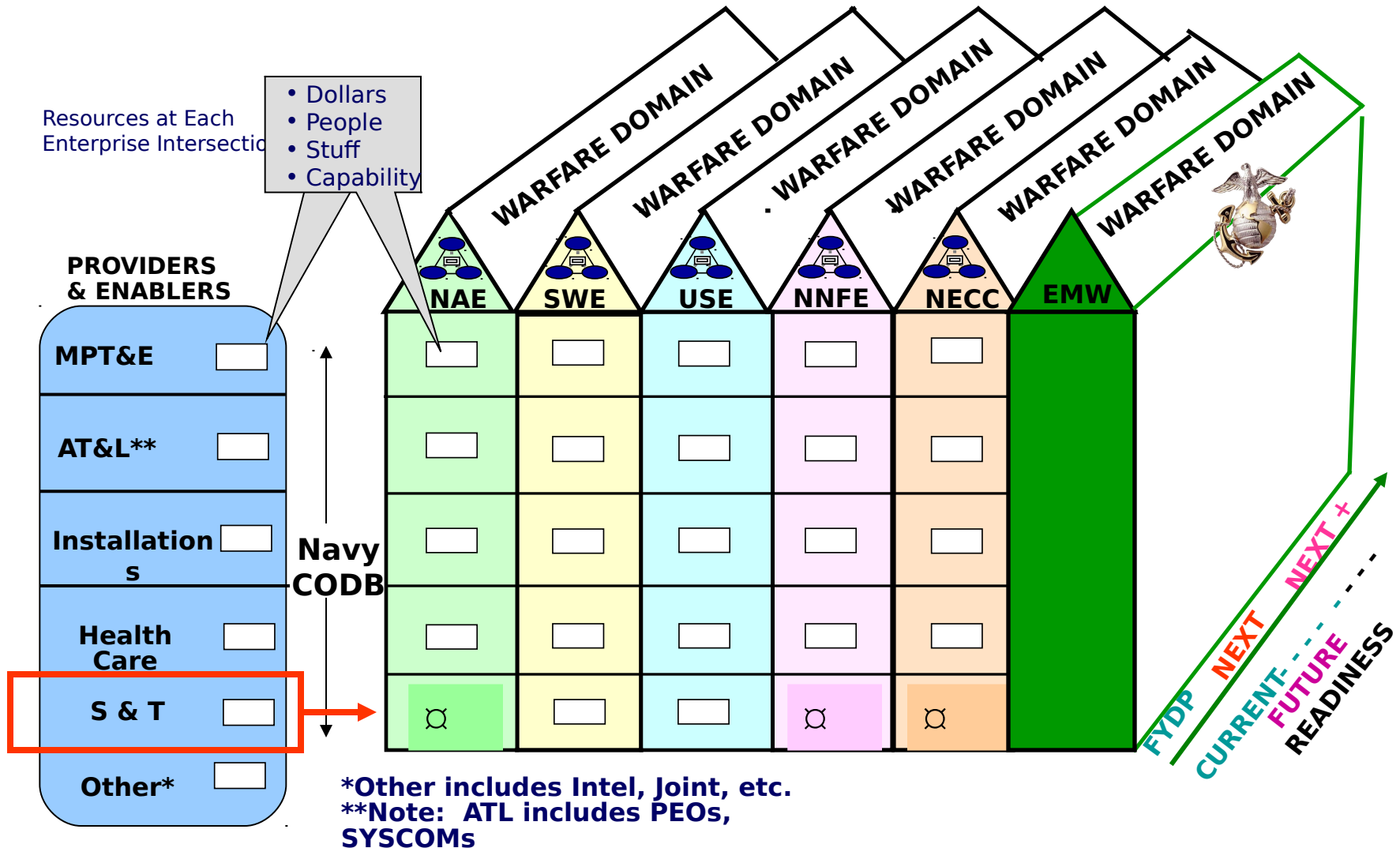
**Science & Technology Objectives**

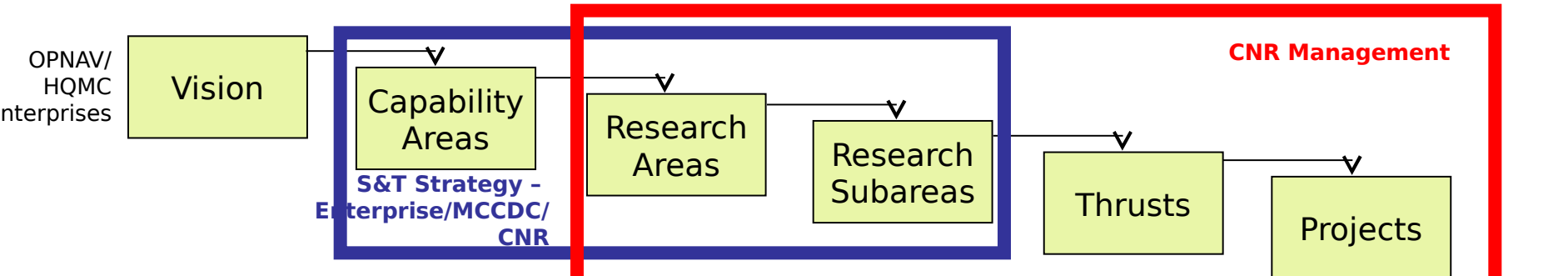
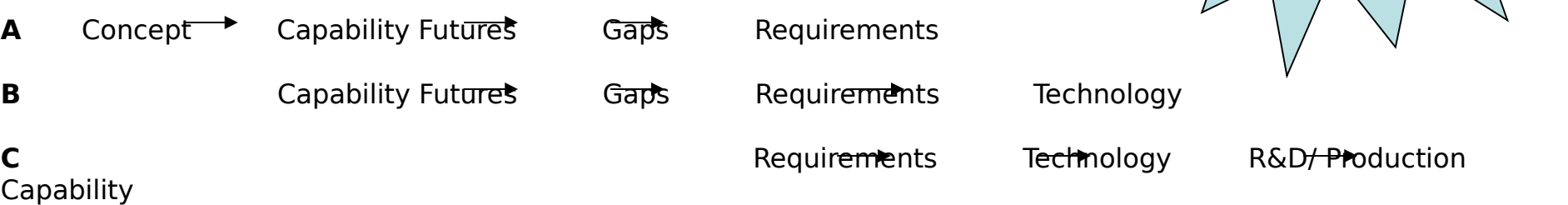
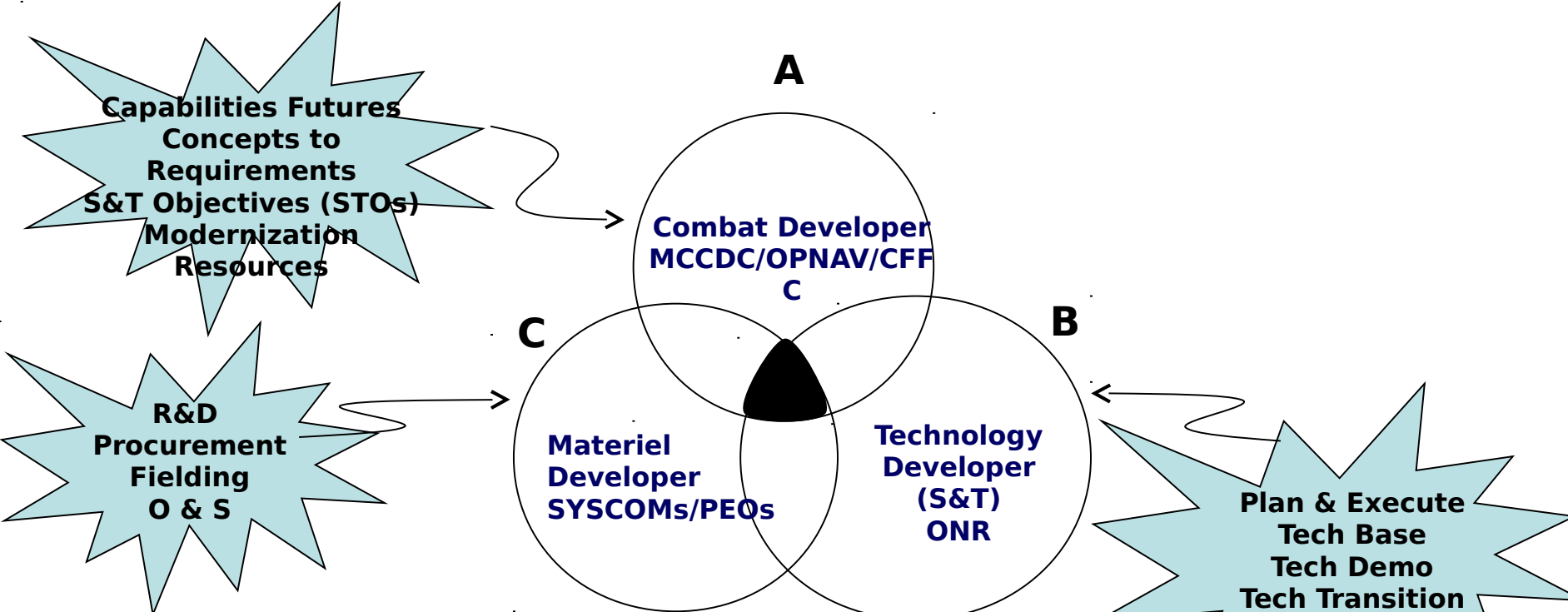
# Navy Enterprises New Operating Concept

**PROVIDERS/ ENABLERS**  
(Supporting Warfare Enterprises)



**WARFARE ENTERPRISES**  
(Delivering Combat Capability to COCOMs)



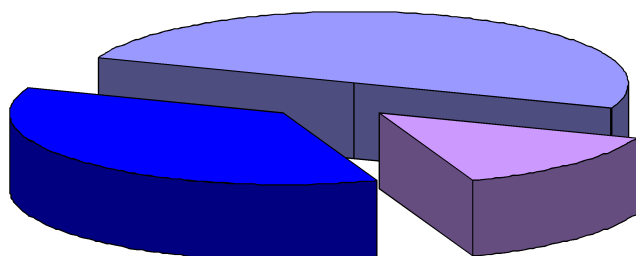


# "M" Program Elements Investment Areas

There Are No  
"Green" 6..1  
Dollars  
(0.6%)



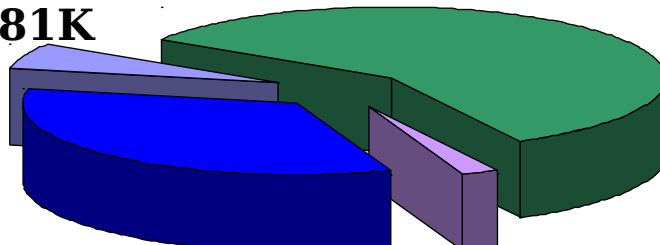
**ONR FNC 6.2**  
\$21,753K



**ONR 30 6.2**  
\$15,988K

**JNLWD 6.2**  
\$6,036K

**ONR FNC 6.3**  
\$3,581K



**ONR 30 6.3**  
\$20,507K

**JNLWD 6.3**  
\$1,405K

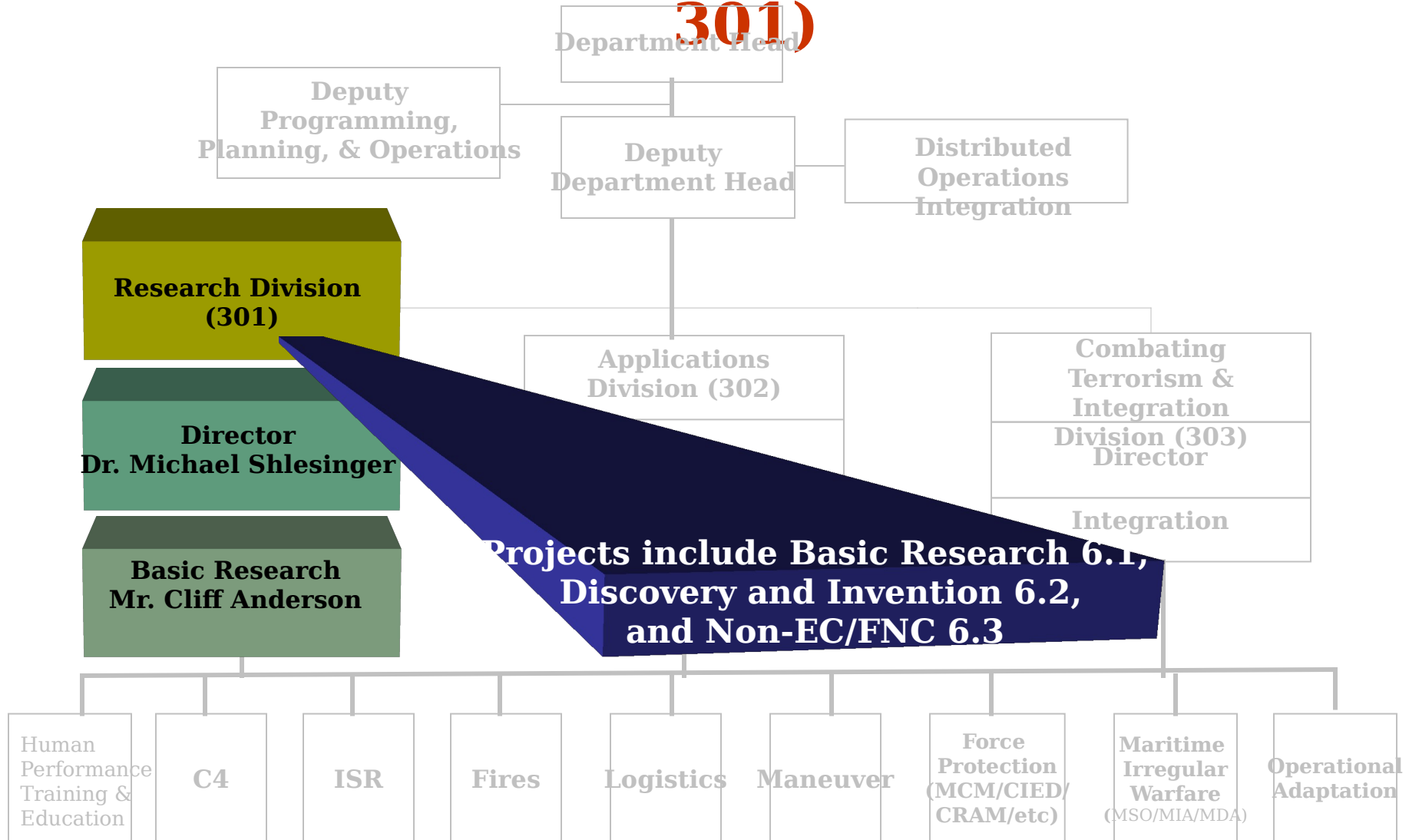
**MCWL 6.3**  
\$35,082K

## Investment Thrust Areas:

<b>C4</b>	<b>Logistics</b>
<b>Fires</b>	<b>Maneuver</b>
<b>Force Protection</b>	<b>Mine</b>
<b>Countermeasures</b>	
<b>Human Performance</b>	<b>Maritime</b>
<b>Irregular Warfare</b>	
<b>Operational Adaptation</b>	



# Research Division (ONR 301)



# ONR 301 Projects

## Basic Research Focus Areas Human Performance, Training & Education

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>- Materials for Forensic Sensing</li> <li>- Landmine Detection</li> <li>- Information Efficiency</li> <li>- Lightweight Power Sources</li> <li>- Communications</li> <li>- Human Sensory Enhancement</li> <li>- Energetic Materials</li> </ul> | <ul style="list-style-type: none"> <li>- Individual &amp; Team Cognitive Performance</li> <li>- Novice to Expert Performance</li> <li>- Cognitive Neuro Approach for Enhancing Training and Performance</li> <li>- Combat Situation Awareness</li> <li>- Counter-Fatigue Interventions</li> <li>- Combat Feeding and Pharmacology</li> <li>- Interactive Immersive Closed-Loop Training System for MOUT</li> </ul> |
|---|--|

## Fires

- Fires From Enclosed Area
- Stoichiometric Optimization
- Variable Blast Warhead
- Caseless Small Caliber Ammo

# ONR 301 Projects (Cont'd)

## ISR

- Tag, Track and Locate
- Transparent Urban Structures
- Modeling Adversary Decision Process in Complex

## Maneuver

- Electromagnetic Non-Explosive Armor
- Advanced Electromagnetic Armor
- Ultra Armored Patrol Vehicle
- Shock Mitigated Seat
- Cognitive Assessment & Task Management
- Combat S&T Vehicle Modeling & Simulation Based Design
- Electronically Controlled Active Suspension
- Combat S&T Vehicle

## C4

- Common Operational Picture Fusion
- Tactical Network Integration
- Non-Line of Sight Communications
- Urban Communications
- GPS Denied Navigation Technology
- Urban Navigation

# ONR 301 Projects (Cont'd)

## **Logistics**

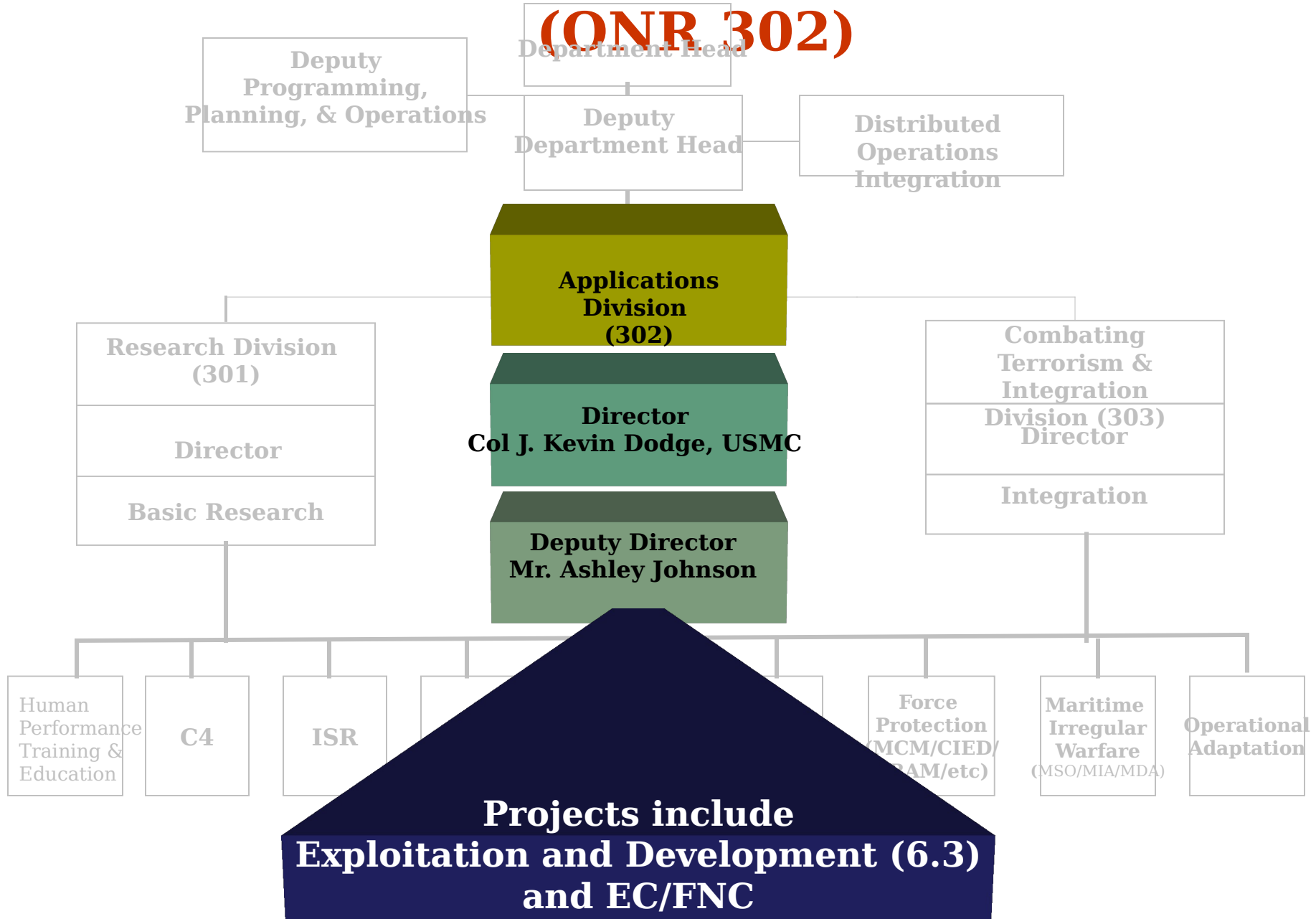
- Autonomic Logistics  
Common  
Operational Picture  
Feasibility  
Study
- Marine Corps Seabasing  
Roadmap  
Study
- Chipless & Surface Acoustic  
Wave  
Radio Frequency  
Identification
- Hybrid Zinc Air Power  
Sources
- New Materials & Concepts  
for Next  
Generation Metal/Air  
Batteries

## **Force Protection/Mine Countermeasures**

- RF Detection of IEDs
- Scalable Shape Charge  
Munitions
- Radio Frequency Directed  
Energy for  
Neutralization of Mines/IEDs
- Smart Mine Sensors  
Countermeasure  
Technology
- Threat Mine Exploitation
- M&S Tools for Mine Blast  
Modeling
- Mine Survivable Testbed Vehicle
- Marine Advanced Combat  
Headborne  
System



# Applications Division (ONR 302)



# ONR 302 Projects

## **Fires**

- Modular Scalable Effects Weapons Concept Development
- EFSS Precision Extended Range Munitions
- Advanced Weapons Material Technology
- Advanced Gun Barrel Technology
- Improved Fire Control System
- Advanced Fires Coordination Technology
- Advanced Target Acquisition

## **Maneuver**

- Active RPG Defense
- Gunslinger Hostile Fire Detection/Response
- EFV Obstacle Detection System
- Battlefield Power Generation

## **Force Protection/Mine Countermeasures**

- Landmine Countermeasures &  
Breaching Mine Clearing Line Charge

# ONR 302 Projects (Cont'd)

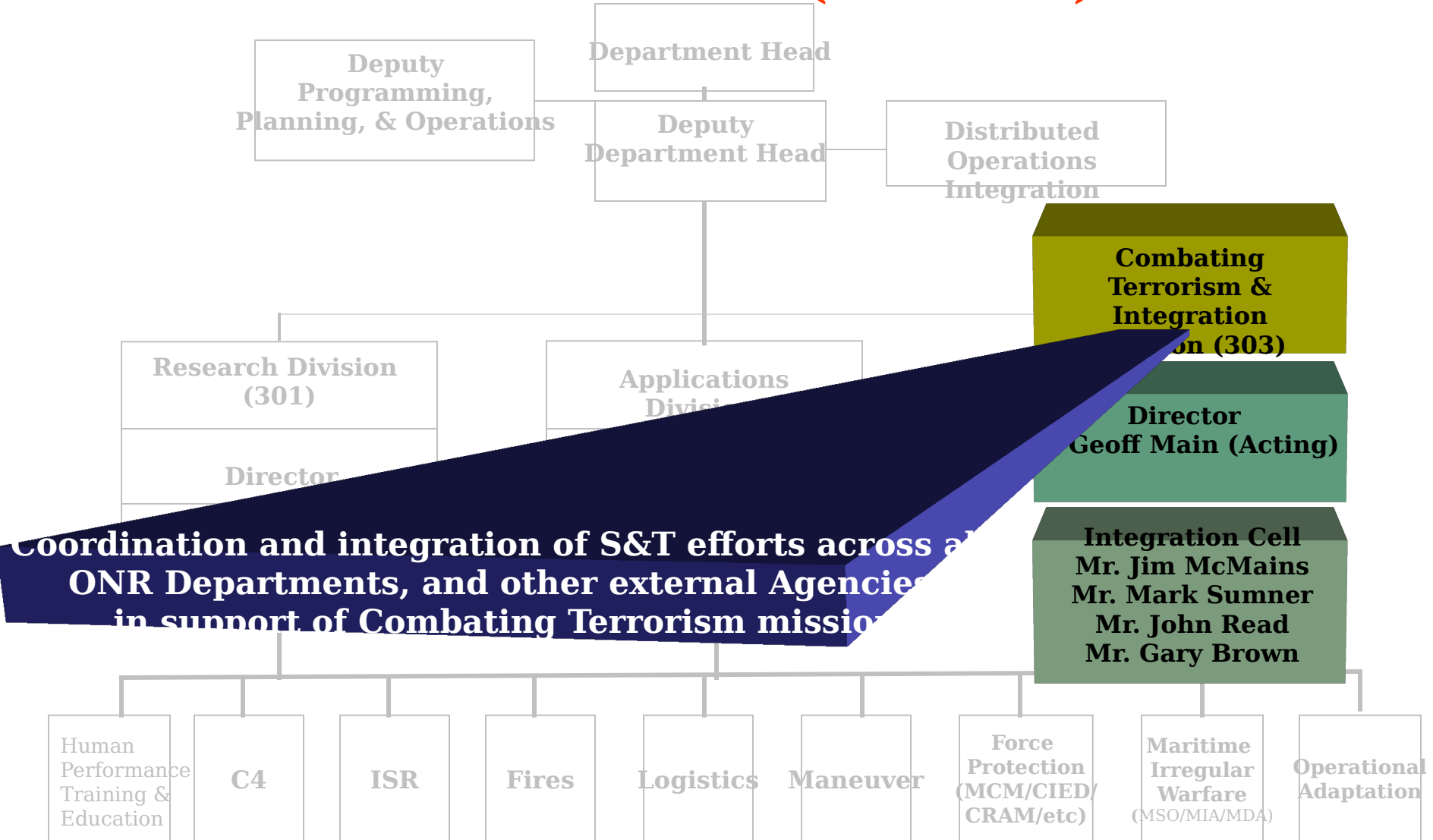
## C4

- Network Monitoring & Management
- Secure Wireless LAN Afloat
- C2 On-the-Move Network Digital Over the Horizon Relay
- Position Location Information
- GPS Denied Navigation
- Advanced Target Acquisition

## ISR

- Design Tools Enabling Mission Specific Sensor Fields
- Remote Sensor Fusion
- Smart Algorithms for Tactical Sensors
- Detect and ID Facilities
- RF Emitter ID and Geolocation
- Sensing Through Walls
- Tactical Littoral Sensing
- Signal Visualization
- Automated Pattern Recognition
- Human to Sensor Field Interface (Smart Data Pull)

# Combating Terrorism and Integration Division (ONR 303)





# Global Maritime Domain Awareness

(GMDA) This capability area will enhance the Warfighter's *"ability to gain awareness, understanding and the opportunity to seize [gain, maintain, or recover] the initiative against our adversaries in the maritime domain."*\* The Maritime Domain includes the blue water, littoral, and riverine environments. This capability area will also address urban and other complex environments presenting critical challenges to current/future naval forces.

- **All Source Collection**
- **Intelligence & Information Analysis & Fusion**
- **Netcentric Dissemination**
- **Persistent, Pervasive, Affordable Surveillance**
- **Tag, Track, and Locate**

\*Quoted from **Navy Strategic Plan** (draft)

# Maritime Irregular Warfare

(MIRW) This capability area will address the development of “new, relevant capabilities to further prosecute the GWOT and contend with the challenge of irregular warfare.”\* The associated enabling capabilities will enhance the Warfighter’s ability to Disrupt & Attack Terrorist Networks†, support Theater Security Cooperation† activities, contribute to Transnational Deterrence†, conduct Maritime Operational Threat Response†, and Combat WMD at Sea & Ashore†.

- **Ship Disabling Non-lethal Systems**
- **Enhanced Maritime Interception Operations**
- **Expeditionary Security**
- **Biometrics**
- **Forensic Site Exploitation & Tac Evidence Collection**
- **Real-time Exploitation of Information & Intelligence**
- **Logistics for Distributed Forces** (Distributed Ops)
- **Extended Small-Unit ISR and Engagement** (Distributed Ops)
- **Enhanced Individual and Small-Unit Mobility** (Distributed Ops)

\*Quoted from **Navy Strategic Plan** (Draft)

† **Navy Strategic Plan**, Key Element

# Operational Adaptation

(OA) This capability area will address the Warfighter's ability to **gain, maintain, or recover the tactical, operational, and strategic initiative over an irregular enemy** by anticipating threat measures/countermeasures and by facilitating the dynamic tailoring of friendly forces, capabilities, actions, and TTPs to defeat these measures/countermeasures. OA provides a capability to dynamically understand what decisions US forces can make or cause the enemy to make in order to generate an exploitable spatial, temporal, physical, or psychological advantage. OA also includes iterative effects based planning and execution.

- ***Warfighting Decision Superiority***
- ***Commander's Preparation of the Environment***
- ***Information Operations and Related Capabilities***
- ***Battlespace Shaping***
- ***Operational Culture Understanding and Communication***
- ***Mission Gaming and Rehearsal***
- ***Adaptive Thinking and Leader Development***

# Counter IED

(CIED) This capability area will enhance the Warfighter's ability to defeat Improvised Explosive Devices (IEDs) as far forward in the kill chain as possible.

- ***IED Prediction***
- ***IED Prevention***
- ***IED Detection***
- ***IED Neutralization***
- ***IED Mitigation***
- ***Technical and Forensic Exploitation***



## **Table of Organization Change Request for T/O #5003; Approved 24 May 2006:**

1 Major / 9652 Defense Systems Analysis

2 Majors / 9624 Electrical Systems

Engineering

SEP Students start in 2007 for a 2009 Fill

## **Prior to the 2009 Fill is the potential for (2) overages for the summer of 2007 - potential billets:**

Logistics Thrust Program Manager,

FP/MCM Thrust Program Manager,

Human Performance Program Manager,

Fires Program Manager

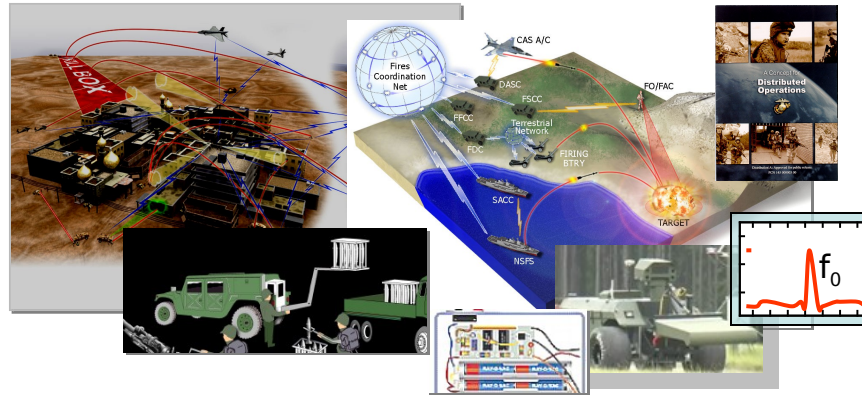
## **Future SEP Billet Initiatives:**

1 Information Warfare Officer/9634

2 Combat Systems Science Officers/9626

# Duty Assignment

## Science and Technology Program Manager



### Billet Description

$$v_{ik} = \frac{1}{n} + \frac{1}{2\delta_i} \sum_{j=1}^N (u_{ij})^m \left[ \frac{\|x_j - c_i\|^2}{n} - (x_{jk} - c_{ik})^2 \right].$$

- Manage, budget, coordinate and direct Marine Corps' Science and Technology (S&T) programs. Includes all cost/schedule/performance/systems engineering functions.
- Develop program goals for S&T funds (6.2/ 6.3) and manage funds and provide oversight of S&T performers including universities, industry and Federal Government Organizations.
- Customer interface to MCSC, MCWL, MCCDC, HQMC, FMF, OPNAV, SYSCOMs, PEO's, DARPA, U.S. Army, U.S. Air Force, and U.S. Coast Guard counterparts.
- Liaison/collaboration with international partners.

# ONR 30 POCs

Name	Title	Phone	Email
<b>Mr. George Solhan</b>	<b>Dept Head</b>	<b>703-696-2789</b>	<b>solhang@onr.navy.mil</b>
<b>Col John Dodge</b>	<b>Deputy</b>	<b>703-696-7148</b>	<b>dodgej@onr.navy.mil</b>
<b>Dr. Mike Shlesinger</b>	<b>Code 301 Division Head (Research)</b>	<b>703-696-4420</b>	<b>shlesim@onr.navy.mil</b>
<b>Mr. Ashley Johnson</b>	<b>Code 302 Division Head (Applicaitons)</b>	<b>703-696-4223</b>	<b>johnsoa@onr.navy.mil</b>
<b>Dr. Geoff Main</b>	<b>Code 303 Division Head (CbT Integration)</b>	<b>703-696-1180</b>	<b>maing@onr.navy.mil</b>
<b>Mr. John Moniz</b>	<b>C4 Thrust Mgr</b>	<b>703-696-2492</b>	<b>monizj@onr.navy.mil</b>
<b>Ms. Vickie Williams</b>	<b>Fires Thrust Mgr</b>	<b>703-696-2549</b>	<b>williav@onr.navy.mil</b>
<b>CDR Dylan Schmorrow, USN</b>	<b>Acting HPT&amp;E Thrust Mgr</b>	<b>703-696-0360</b>	<b>schmord@onr.navy.mil</b>
<b>Mr. Martin Kruger</b>	<b>ISR Thrust Mgr</b>	<b>703-696-5349</b>	<b>krugerm@onr.navy.mil</b>
<b>Maj Alan Stocks</b>	<b>Logistics Thrust Mgr</b>	<b>703-696-2561</b>	<b>stocksa@onr.navy.mil</b>
<b>Mr. Jeff Bradel</b>	<b>Maneuver Thrust Mgr</b>	<b>703-696-2552</b>	<b>bradelj@onr.navy.mil</b>
<b>Mai Bill Short</b>	<b>MCM Thrust Mgr</b>	<b>703-696-6993</b>	<b>shortb@onr.navy.mil</b>

# ***QUESTIONS?***

